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Composite Materials and Structures Certificate

Advanced Structures & Composites Center, University of Maine

Composite Materials and Structures Certificate

Certificate Coordinators

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Requirements

The Certificate requires completion of 12 credits (4 courses) through a combination of 400- and graduate-level courses as described in the course sequence section below. A maximum of one course (or 3 credits) at 400 or 500 level may be transferred from outside of UMaine to the program for credit.

- Undergraduate category: Student must complete 12 credits with a minimum GPA of 2.5 and a minimum grade of C⁻ in each course.
- Graduate category: Student must complete 12 credits with a minimum grade of C in no more than one course. At least three courses (9 credits) must be at 500 or 600 level.
- Other category: Applicant (e.g., an individual not enrolled in any degree program at UMaine) must complete 12 credits with a minimum grade of C in each course.

The Certificate program shall be completed within 3 years from the date of acceptance into the program.

Course Sequence

a. Core Courses (6 credits)

MEE 441/541 Manufacturing and Testing of Composites
An introduction to the manufacturing and material property determination of fiber reinforced polymer materials. Includes fabrication, post-processing, and testing of thermoset and thermoplastic composite materials. Lec 1, Lab 2. Prerequisites: MEE 251 or MEE 252 or MET 219 or permission from the instructor.

and

MEE 450 Mechanics of Composite Materials
Introduction to the behavior of composite materials and their use in engineering structures; fabrication methods, behavior and properties of the constituent fibers and matrices, micromechanical predictions of composite properties, anisotropic elasticity, behavior of composite laminae, classical lamination theory, failure theories, composite beams and plates, material characterization and introduction to the design of composite structures. Lec 3. Prerequisites: A grade of C or better in MEE 251.

or

CIE 543 Introduction to Composite Materials in Civil Engineering
An introduction to the mechanics of fiber-reinforced polymer (FRP) composite materials in civil engineering with a view to structural design. Understanding of material properties, fabrication processes, fundamental mechanics, experimental procedures and methods of analysis and design. Lec 2, Lab 1. Prerequisites: Senior or graduate standing in Engineering or Wood Science and Technology; MEE 251 or equivalent and CIE 340 or equivalent. The student should have at least one course each in mechanics, calculus/linear algebra and computer programming.

b. Elective Courses (6 credits, any two from the list below)

MEE 550 Mechanics of Laminated Composite Structures
3-D anisotropic constitutive relations. Classical lamination theory and boundary conditions for composite beams, plates and shells. Boundary value problems and solutions for static loads, buckling and vibrations. Higher order theories incorporating shearing deformation and layerwise theories. Interlaminar stresses and edge effects. Lec 3. Prerequisites: MEE 450 or permission.

CIE 644 Advanced Composite Materials in Civil Engineering
Advanced course on engineering mechanics and structural applications of composite materials. Fiber reinforced composites in civil-infrastructure; Viscoelastic response; Fracture, fatigue and impact behavior; Durability; Characterization of structural composite materials; Strength and stiffness design criteria; Engineered Interfaces; Connections; Bridge structures; Strengthening of Reinforced Concrete; Strengthening of Wood. Out of class laboratory assignments will be required. Lec 3. Prerequisites: CIE 543; graduate standing in Engineering or Wood Science and Technology or permission.

SFR 531 Mechanics of Wood and Wood Composites
Application of orthotropic and nonlinear constitutive relations, laminate theory, and failure criterion on the prediction of mechanical properties of solid wood, wood fibers, laminated, and other wood composite materials. Lec 3. Prerequisites: SFR 425 or equivalent or permission.

SFR 545 Adhesion and Adhesives Technology
Fundamentals of adhesion and adhesives including surface science, chemistry and properties of adhesives, adhesive bond evaluation and applications in composite materials. Lec 3. Prerequisites: Senior standing or permission.

SFR 550 Wood-Polymer Hybrid Composites
Fundamentals of fiber reinforced polymer (FRP) materials, manufacturing and performance characteristics. Addresses issues of combining wood with FRP's such as interfacial properties and durability of the resulting wood-polymer hybrid composite materials. Lec 3. Prerequisites: SFR 454 or permission.

SFR 570 Cellulose Nanomaterials and Their Composites
Comprehensive coverage of the production, characteristics, processing, applications and performances of renewable nanomaterials and their composites. The graduate level course will provide fundamental information on various types of cellulose nanomaterials as well as their performance in target applications. Students may be required to conduct individual/team experiments, visit production sites and hold informal meetings as scheduled along the course of the semester outside the original time frame. Lec 3. Prerequisites: Recommendation of the student's advisory committee or permission of the instructor.